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# **Assessing The Value Of Quality And Food Safety-Related Attributes: A Hedonic Analysis Of Chinese Meat Price**

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## **Abstract**

The market for meat in China is quite diversified and it is potentially the largest in the world. Understanding how meat prices are related to quality in Beijing, China will provide guidance for industry and policymakers interested in the Chinese meat market. In this paper, the implicit prices of meat with the quality-related attributes from both supply and demand sides are investigated using a hedonic price model. Five meat categories are regressed on several attributes or characteristics derived from supply and demand using household survey data collected in Beijing in 2007.

The key results in the current analysis indicate that quality-related attributes or characteristics such as meat appearance, supermarket, meat brand, and semi-processed meat as well as demographic variables such as household head's income have a significantly positive influence on the price of meat, which suggest that the consumers in Beijing are willing to pay a price premium to guarantee the quality and safety of meat. In addition, the household wife's educational levels and number of children also affect the implicit value of meat.

Key words: hedonic analysis; meat; quality; China

# **Assessing The Value Of Quality And Food Safety-Related Attributes: A Hedonic Analysis Of Chinese Meat Price**

## **Introduction and Background**

China's increasingly affluent consumers have contributed to a structural change in its food consumption and an escalating demand for high quality food over the last decade (Gale and Huang, 2007; Yu and Abler, 2009). For example, per capita annual consumption by urban households of traditional staple foods (grains) fell from 130.72 kilograms in 1990 to 77.60 kilograms in 2007 as disposable income rose. Also per capita meat and seafood consumption increased from 32.85 kilograms in 1990 to 46 kilograms in 2007 (China Statistical Yearbook, 2008). High income Chinese consumers place more emphasis on the quality of food rather than price in their purchasing decisions (Gale and Huang, 2007). However, recent crisis of food quality in China which includes incidents such as the blue-ear disease and the melamine-contaminated infant formula scandal have raised tremendous concerns about the quality of food in the Chinese market. Faced with food quality issues, more and more Chinese consumers are willing to pay at least a modest premium for food that meets a high quality standard or is free of dangerous contaminants (Gould, 2004; Calvin *et al.*, 2006; Wang *et al.*, 2008).

Theoretically, product quality can be described as a bundle of quality-related attributes (characteristics) that determine the product's performance (Caswell and Mojduszka, 1996). According to Caswell and Mojduszka, major categories of food product quality attributes, which can be regarded as having a demand and a supply that interact to determine a market clearing price, include the effect of food safety, nutrition, value, packaging, and brand attributes. Consumers choose foods with high quality in order to

maximize expected utility. Sometimes information on food quality for consumers is featured in the media or delivered by certain groups such as health care professionals, the government, consumer groups, or food processors (Caswell and Joseph, 2007). High income urban Chinese consumers have an inelastic demand for the quantity for most foods, and the demand for food quality rises with the growth of income (Gale and Huang, 2007). Thus, the impact of consumers' demand for high quality food must be considered in terms of food industry developments and market segmentation.

Frequently, in asymmetric information markets, the information for food quality is not perfect. The most imperfect situations are that sellers are better informed about quality than consumers (Caswell and Mojduszka, 1996). Under this condition, consumers have to rely on certain quality-indicators and cues to assess the quality of food products such as intrinsic and the extrinsic attributes or characteristics (Gao and Schroeder, 2009; Zhang *et al.*, 2010). These attributes can be presented from either the supply or demand side. In general, the supply side attributes are associated with the actual product itself during the production and distribution whereas the demand side attributes relate to promotional and informational characteristics of the product which are perceptible for consumers (Loureiro and McCluskey, 2000; Parcell and Schroeder, 2007). Examples of demand attributes in the meat category include meat appearance, brand and certification since they could be evaluated by the perception of consumer. Traditionally, such attributes are the main criteria for Chinese consumers to evaluate the quality of food during their purchasing behaviors. But in an asymmetric information market, these kinds of attributes may fail in the consumer's assessment of meat quality and safety (Zhang *et al.*, 2010). Therefore, consumers have to depend on other attributes or cues from both supply and demand side

such as purchase venue and processed form to determine the quality of the meat they purchase.

Consumers have become more discriminating in their food purchasing decisions over the past decades (Barkema, 1993). Chinese consumers also shift their preference on food from quantity to quality gradually. For instance, a sizable portion of consumers in Beijing are likely to consume foods which carry safety certification logos, such as the label of “Green Food” or “Organic Food” (Wang *et al.*, 2008). Currently, China has in place a domestic certification system of food quality and safety standards.

Sometimes, retail price reflects the qualities embodied in a commodity, which suggests that products with satisfactory quality-related attributes or cues may have a relatively high price to indicate their high quality. Consumers may purchase foods with different attributes or characteristics at different prices, based on their needs and income level (Harris, 1997). However, research examining how consumers in Beijing value these quality-related attributes in both supply and demand sides for meat category is still unknown.

Previous empirical studies that estimate the added value of quality-related attributes of individual products provide guidance for this paper. In general, some of the articles discuss the choice of appropriate methodologies and others focus on the specific quality-related features. For example, Wahl *et al.* (1995) follow Rosen’s approach and apply hedonic price analysis to estimate Wagyu beef characteristics using Japanese Wagyu auction data. They find that beef characteristics, especially marbling, have significant effects on the prices paid at auction for Wagyu beef carcasses. Carcass price is also influenced by several measured characteristics or qualities, such as rib-eye size, meat

firmness and texture. Wahl *et al.*'s analysis concludes that knowledge of the implicit values of Wagyu carcass characteristics enable U.S. beef producers and exporters to compete with Japanese producers more efficiently. Another hedonic price analysis conducted by Melton *et al.* (1996) also uses auction data to evaluate consumer perceptions, willingness-to-pay, and attribute values for fresh pork chops, which include color, marbling and size. Their results confirm that consumers can distinguish the subtle differences in embodied attributes of fresh pork and are able to value these differences across presentation formats. Loureiro and McCluskey (2000) analyze the effect of "protected geographical indications" (PGI) labels on the purchase of fresh meat in Spain. Their results suggest that consumers are likely to pay premiums for labeled products, but intrinsic variables, such as fat content and color, are not important factors in determining retail price in Spain. Roheim *et al.* (2007) estimate a hedonic pricing model on retail data from frozen seafood in the UK market. Their results show that species, branding, process form, package size, and product form can add to the value of seafood, and seafood producers could segment the product in reaching the different target markets. In addition, Gao and Schroeder (2009) estimate the marginal effects of additional label information on consumer willingness-to-pay (WTP) for food quality attributes. Their results show that consumer WTP for cue attributes such as "Certified U.S. Product" tends to be affected more than independent attributes. As additional information on food attributes are provided, consumer WTP changes significantly.

We begin this paper with the hedonic technique which includes quality-related attributes or cues as well as demographic variables as the independent variables, following Rosen's (1974) theoretical framework. In order to statistically estimate the implicit value of

meat's attributes in the sides of demand and supply which are associated with quality, we use the data from an urban Beijing survey, which were collected in 2007 by the Chinese Academy of Sciences. The results of estimating the hedonic price model include the coefficients and marginal effects, which are then presented and discussed. In a final section of the paper, we provide conclusions and implications for this study.

## **Empirical Methods**

Empirical work on quality of products is mostly based on a procedure referred to as the hedonic technique, and this is usually justified in terms of household production theory (Deaton and Muellbauer, 1980). Economic hedonic price analysis has been widely used to analyze consumers' implicit valuation of the attributes or characteristics of food products (Morgan et al., 1979; Brester *et al.*, 1993; Wahl *et al.*, 1995; Melton *et al.*, 1996; Harris 1997; Loureiro and McCluskey, 2000; Maguire *et al.*, 2004; Parcell and Schroeder, 2007; Roheim *et al.* 2007; Wang *et al.*, 2008; Minten and Reardon, 2008). The reason is that hedonic framework allows the estimation for the price of different food characteristics. And food attributes can be either intrinsic or extrinsic (Parcell and Schroeder, 2007). The formal derivations of the hedonic price model are driven by Rosen (1974) from a market-determined approach. Briefly, Rosen's model can be described to demonstrate how people objectively evaluate the price of the products in which some attributes are embodied by consumers' perceptions (Rosen, 1974; Wahl *et al.*, 1995). In practice, both the producer and consumer's optimal behavior can be represented by this approach (Maguire *et al.*, 2004).

Following Rosen's approach, a market equilibrium hedonic price model is driven from the tangency point between the consumer's optimal bid curve and the producer's

selling curve (Rosen, 1974). In our case, the Beijing consumers purchase one unit of  $j$ th meat, which includes beef, pork, lamb, poultry and other meat. The meat consists of  $n$  kind of attributes:  $z_i = \{z_1, z_2, z_3, \dots, z_n\}$ . These attributes are both on the demand side (i.e., meat's appearance, brand and certificate) and the supply side (i.e., processed form and purchasing venues). The hedonic price model can be derived as following:

The consumer's utility function is

$$f(x) = U(x, z_1, z_2, \dots, z_n), i = 1, 2, \dots, n \quad (1)$$

where  $x$  is all meat types consumed. The budget constraint is

$$m = x + p(z) \quad (2)$$

where  $m$  is the income, and  $p(z)$  is the price of meat which consists of the attributes. We take the first-order conditions to maximize the consumer's utility subject to the budget constraint and then yield the following equation:

$$\frac{\partial u / \partial z_i}{\partial u / \partial x} = \frac{\partial p}{\partial z_i}, i = 1, 2, \dots, n. \quad (3)$$

The individual consumer achieves the optimal utility when the marginal rate of substitution between an attribute of meat,  $z_i$ , and meat types consumed is equal to the marginal price of that attribute. In another words, consumers will choose a unit of meat with some embodied attributes at an optimal price which maximizes their utility.

On the supply side of the market, the goal of meat suppliers or producers is to maximize their profits by producing the meat which contains component attributes  $z_i = \{z_1, z_2, z_3, \dots, z_n\}$ . Suppose the meat producer produces  $F$  units of meat and the costs of production are  $c(F, z_i)$ . Therefore, the profit function is

$$\pi = Fp(z) - c(F, z_i).$$

And the meat producer can maximize profits holds the following condition:



$$\frac{\partial p}{\partial z_i} = \frac{\partial C / \partial z_i}{F}, i = 1, 2, \dots, n \quad (5)$$

In an equilibrium market,  $\frac{\partial p}{\partial z_i} = \frac{\partial C / \partial z_i}{F} = \frac{\partial u / \partial z_i}{\partial u / \partial x}$ , which indicates that both meat producers and consumers could achieve the optimal behavior under the price of attributes  $z_i$ . Under this condition, the market equilibrium hedonic price model can be estimated by regressing the equilibrium prices of meat on some quality-related attributes in both supply and demand of meat itself. A general hedonic model for meat in our study can be described in equation 6.

$$p_j = h(S_{ij}, D_{ij}, E_i), j = 1, \dots, J, \text{ and } i = 1, \dots, n \quad (6)$$

where  $p_j$  is the price of  $j$ th kind of meat, such as beef,  $S_{ij}$  is a vector of quality-related attributes on the supply side for the  $j$ th meat (i.e. processed form and purchasing venue), and  $D_{ij}$  is a vector of attributes embodied in the demand side for the meat (i.e. meat appearance, certificate and etc.), and  $E_i$  is the economic and social demographic information of Beijing consumers. (e. g., household income and number of children)

The marginal effects directly measure how the market price responds to a finite change in the product attributes (Wahl *et al.*, 1995). The marginal effects, which respect to particular characteristics  $z_i$ , can be expressed as

$$ME = p^* - p = \exp\left(\sum_{j=1} \beta_j z_j + \beta_i (1 + \alpha_i z_i)\right) - p \quad (7)$$

if  $z_i$  is a continuous variable, and

$$ME = \exp(\beta_0) (\exp(\beta_i) - 1) \quad (8)$$

if  $z_i$  is a dummy variables.  $\beta_i$  are the parameters and  $\alpha_i$  is the percentage change in  $z_i$ , which is  $\alpha_i = \Delta z_i / z_i$ . We set  $\alpha_i = 10$  percent in our case.  $p^*$  is the new price level due to the change of product characteristics.

## Data and Sampling Description

The data we use in this study are collected from a survey administered in Beijing using a statistical random sample of the panel used for the Urban Household Income and Expenditure (UHIE) survey. The survey data specifically for this study are collected by interviewing the person most familiar with the food shopping and food consumption in each randomly selected household (Zhang *et al.* 2010). In this study, 100, 100, 60 and 60 households are randomly selected from four districts (Chaoyang, Haidian, Fengtai, and Dongcheng), respectively. The survey results in 315 useful household observations with 1429 recorded observations of meat consumption over 7 days and up to 3 meals per day per household member. The meat consumption records include 738, 167, 54, 210, and 260 observations of pork, beef, lamb, poultry, and other meats (edible offal), respectively.

This survey includes two parts. The first includes socioeconomic and demographic information, which is collected in face-to-face interviews by enumerators. The second part includes food consumption information collected using a diary record method in which the selected households are asked to record the quantity, price, and the purchase venue of meat they consumed for every meal in a week. The individual household is also asked to rank the importance of five factors from 1 to 5 (1 least, 5 most) to determine food safety, which is an important indicator for meat quality. These five factors are certification, brand, purchase venue, price, and appearance. And based on the features of these indicators, we define the variables on both demand and supply side.

In previous empirical analysis, researchers use unit values for price, which can be obtained by dividing expenditures by the quantity consumed, instead of actual price data (Gould and Dong, 2004; Ma *et al.*, 2004; Gale and Huang, 2007; Yu and Abler, 2009). But

relying on unit values can bias empirical analysis because they are not exogenous market prices (Yu and Abler, 2009), and the effects of non-quality related factors cannot be separated from price effects in most cases. According to Yu and Abler (2009), the income elasticity is likely to be biased upward, while the absolute value of the own-price elasticity will be biased upward for a normal good and downward for an inferior good if unit values are used. In this case, our survey provides an ideal dataset, which contains information on the actual prices of meat which eliminates the problem of using unit values as prices.

Table 1 presents the description of variables used in the model including venue and household demographics. Venues vary from supermarkets and convenience stores to wet markets, and even to small street vendors. Different purchase venues can reflect consumer's purchase behavior as well as added-value aspects provided by each venue. Thus, different types of venues are considered as the supply side variables for the quality attributes which may influence the real prices of meat.

The Chinese government and other related authorities have invested large amounts of social, economic, and political resources to develop and implement quality or safety-related certification programs for food including certifications as “Quality Safety (QS)” and “Green Food” (Zhang *et al.*, 2010). Meat need to be inspected by authorities before supplying to the market. When consumers purchase meat and meat products, certification logos or brands are an important indicator for them to evaluate the quality. Furthermore, household income is a significant determinant for the demand or willingness to pay for high quality food in the previous studies. For example, Gale and Huang (2007) point out that those Chinese consumers, who have high household income levels, are willing to pay more for meat and meat products to guarantee safety and reliability. Household income

excluding wives' earnings and the square of the household income are added to the model in order to test the effects of household income on the price premium of meat and its tendency of willingness to pay in the future.

**Table 1 Description of Variables**

Variables	Description
<b>Actual Price</b>	
Price	price per 1 kilogram of meat (Yuan)
<b>Quality-related Attributes</b>	
Supermarket	= 1 if meat is supplied by supermarket, = 0 otherwise
Wet Market	= 1 if meat is supplied by wet market, = 0 otherwise
Processed (ready to eat)	= 1 if meat product is ready-to-eat, = 0 otherwise
Semi-processed	= 1 if meat product is semi-processed by supplier, = 0 otherwise
Meat appearance	= 1 if consumer ranks appearance as the determining factor for food safety
Meat Certificate	= 1 if consumer ranks certificate as the determining variable for food safety, = 0 otherwise
Meat Brand	= 1 if consumer ranks brand as the determining factor for food safety, = 0 otherwise
<b>Demographic Variables</b>	
Child	Number of Children in the household
Wife's Education	Household wife's educational level (rank from 2 to 6)
Household Income excluding wives' earnings	Household's monthly income excluding wives' earning (1000 Yuan/Month)

Note: 1. The processed meat is ready-to-eat meat and fully cooked by supplier.  
 2. Wife's educational level ranked from 2 to 7, where 2 means primary school and 7 indicates above bachelor's degree.  
 3. Child is the member of household members that are 16 years old younger.

Family size and structure are also important determinates of the price that Beijing consumers are willing to pay. Maguire *et al.* (2004) suggest that the number of children in the family has a positive effect on the evaluation and consumption of food. At the same time, household wives play an important role on making the purchases for the whole family in China. The education of household wives is included in our model to capture the variation in the wives' awareness of quality, safety, health and nutritional information related to meat consumption, which may help consumers to value the implicit price of quality meat.

### **Estimation Procedure**

The hedonic price model with five meat categories, including pork, beef, lamb, poultry, and other meat is estimated using STATA. Also, in order to compare consumers' willingness to pay (WTP) with the average price of meat, the actual price of meat is treated as the independent variable. Therefore, based on equation 6, the hedonic price function is regressed by Ordinary Least Squares (OLS) in the semi-log form as follows:

$$\begin{aligned} \text{Log}(\text{Price}) = & \alpha + \beta_1(\text{Appearance}_j) + \beta_2(\text{Semi - processed}_j) + \beta_3(\text{Super Market}_j) \\ & + \beta_4(\text{Wet market}_j) + \beta_5(\text{Processed}_j) + \beta_6(\text{Certificate}_j) \\ & + \beta_7(\text{Brand}_j) + \beta_8(\text{Child}_j) + \beta_9(\text{Wife's education}_j) + \beta_{10}(\text{Income}_j) \\ & + \beta_{11}(\text{income}^2_j) + \epsilon \end{aligned}$$

where Price is the price per kilogram of meat in Beijing. Appearance, meat certificate, and meat brand are included as quality-related attributes on the demand side of meat  $j$ . Super market, wet market, semi-processed and processed are the attributes embodied in the supply side of meat  $j$ . Child, wife's education level, and household income are demographic variables included.  $\epsilon$  is a random term with zero mean and constant variance.

A semi-log form for the hedonic function is chosen because this form is straightforward to explain as the percentage changes in the price with respect to a 1 unit increase or improvement in the attributes of meat. On the other hand, the actual price of an attribute may be a function not only of the level of attributes itself, but also the levels of other attributes, where the semi-log form can be applied as a nonlinear function of all set of the attributes to deal with the problem (Wahl *et al.*, 1995). Descriptive summary statistics for price, supply and demand attributes of these five meats, and demographic variables are presented in table 2.

### **Hedonic Model Results and Discussion**

The hedonic model is estimated including both supply and demand attributes. There are a total of 1,430 observations. The  $R^2$  for the hedonic model is 0.985, which indicates that all of the independent variables have a high explanatory power in explaining the actual price of meat. A Wald test statistic is applied to test the significance of each independent variable. Overall, all of the independent variables are jointly and highly significant with an F- stat equals 1571.06 and the  $p$ -value of the whole model is less than 0.000. Table 4 presents the results of the hedonic meat price model of Beijing consumers and table 4 shows the marginal effect for each of the meat categories. In order to analyze the implicit value of the regression results, the variables about supply and demand attributes for the five meat categories are discussed in the following parts.

**Table 2 Descriptive Summary Statistics**

Variable	Mean	Std. Dev	Min	Max
Pork Price	23.493	8.021	2.000	102.4
Beef Price	31.372	14.42	2.400	78.50
Lamb Price	26.148	6.234	1.000	57.00

Poultry Price	22.704	9.091	2.000	59.60
Other Meat Price	27.42	11.85	2.000	72.00
Appearance	0.407	0.491	0.000	1.000
Semi-process	0.121	0.326	0.000	1.000
Process	0.296	0.457	0.000	1.000
Supermarket	0.805	0.397	0.000	1.000
Wet Market	0.105	0.308	0.000	1.000
Certificate	0.316	0.465	0.000	1.000
Child	0.301	0.468	0.000	2.000
Wife's education	4.384	0.928	2.000	6.000
Income	5470.95	2303.32	900.0	15000

Note: 1. The other meat includes edible offal and fat in this analysis  
2. Income is the household income excluding wives' earning (Yuan/month)  
3. Price: Yuan/Kg

### **Semi-processed**

In this study, semi-processed is considered as a quality-related attribute on supply side for meat. This kind of meat has been made an initial process before supply to the market, and consumers need a further process before eat. The estimation result shows that the attribute of semi-processed has a significantly positive influence on the price of beef, poultry and other meat. The marginal effects for the three meats are 3.285, 6.618 and 1.431, respectively. The reason may be that semi-processed meat saves the time for increasingly prosperous and busy consumers in China because consumers are able to eat the product with minimal additional preparation or cooking before eating. Consuming semi-processed meat has a lower opportunity cost than cooking raw meat and thus Beijing consumers are willing to pay a higher price. Also, the consumers feel that semi-processed foods are safer than raw meat as raw meat perish easier and quicker than semi-processed meat.

### **Fully Processed or Ready to Eat**

Ready-to-eat is a potential and important attribute for the positioning of meat retail products among consumers and for targeting certain market segments (Roheim *et al.*,

2007). Ready-to-eat meat includes extra labor cost and ingredients, such as spices and flavoring, that have been added in the cooking process and is ready to consume without further preparation which provides a quick and easy meal for increasingly busy people in urban China. Based on this, we consider ready-to-eat as an attribute embodied in the supply side. Thus, we assume that the ready- to-eat form could have a significant effect on the implicit price of meat. However, from our results, this attribute for all meat categories is not significant except for pork, and the sign of processed or ready-to-eat pork is significantly negative. The reason for the negative sign may be that the attribute of processed or ready-to-eat is insufficient for Beijing consumers to evaluate the quality of pork. They do not solely rely on this attribute when they make a purchase decision.

#### **Purchase Venue**

Supermarkets are spreading faster in China than another anywhere else in the world and are growing by 30 percent to 40 percent per year (Hu *et al.*, 2004), and there are a great number of commodity producers and suppliers participating in the supply chains for supermarkets. According to Hu *et al.* (2004), most of the supermarkets in China have their own quality and safety standards imposed on the participating commodity producers and suppliers in order to guarantee the safety and quality of food they sell. In contrast, in wet markets, which are the traditional places for Chinese consumers to purchase meat, vegetables and fruits, consumers can purchase food directly from the farmers and growers. Purchasing directly from the producer can ensure the freshness, affordability and convenience and is the reason a considerable number of wet markets still exist in urban China. However, due to lack of safety standards and inspection systems for the wet markets in China, the foods sold in wet markets cannot guarantee the safety and quality of



meat. Consumers can judge the quality only by directly observing the meat's appearance or perhaps relying on the individual seller's reputation.

In our case, the variable of supermarkets has a positive and significant influence on the price of pork and beef, but it has a significantly negative effect on the value of poultry, in which the marginal effects are 2.941, 2.829, and  $-3.449$ , respectively. The parameter estimates for wet market are significant and have a negative sign for lamb, poultry and other meat. The marginal effects for the three meat categories are  $-11.15$ ,  $-7.678$ , and  $-6.364$ , respectively. Thus, we can conclude that consumers in Beijing are likely to pay a price premium if pork and beef are sold in supermarkets, which is an attribute in the side of supply. Consumers rely more on supermarkets for their daily purchase of pork and beef rather than in wet markets, especially when considering the safety and quality issues of meat. Price is no longer the only incentive for a rational consumer to shop in wet markets. The significantly negative signs for poultry in both of supermarkets and wet markets may be the H5N1 avian influenza was overspread in the middle and eastern part of mainland China during the survey days in 2007

### **Meat Appearance**

Meat appearance is the most direct and the first criterion for a consumer to judge the quality of meat. Therefore it is supply side variable in the model. A good meat appearance is always related with good smelling, nice color, appropriate portion of fat and leans, and cut. Sometimes a meat with good appearance could attract consumers' attention and influence their purchasing behavior easily. In our analysis, the estimated parameters of meat appearance are significant for beef, lamb and poultry. The appearance has a positive effect on the price of beef and lamb, and their marginal effect is 1.544 and 13.023 respectively, which indicates that one unit of improvement on beef and lamb's appearance

can make the consumer pay an extra 1.544 and 13.023 Yuan as the price premium for their quality. However, appearance has a significant influence with a negative sign on the price of poultry, which means that consumers in Beijing who rely on poultry's appearance as the most important evaluation criterion for poultry's price are not willing to pay a premium for this indicator. The reason may also be explained as the spread of H5N1 as we discussed above. The consumers in Beijing were not confident about the safety of eating poultry, so they could not give a positive valuation for poultry based on its appearance.

### **Meat Brand and Certification**

Meat brand is a relatively new concept in China, which has recently attracted more consumers' attention and has begun to develop brand loyalty among Chinese consumers. Some consumers prefer to choose meat or meat products with well-known brands. Therefore meat brand is considered as an attribute on the demand side. Sometimes, brand is a value-added factor which can affect the price significantly. In our analysis, meat brand has a positive and significant sign for the price of beef, lamb, and other meat, which Beijing's consumers are willing to pay 1.884, 13.311, and 1.446 Yuan more per one kilogram, respectively, for a certification is the quality indication of this variable. The reason is that people think the most well-known and famous brands could guarantee the safety of meat since these brands have introduced quality control systems, such as ISO 90001, to ensure quality and standards.

The Chinese meat certification system is an oblige system imposed on all meat producers in China in order to ensure the basic quality and safety of meat. In our analysis, meat certification has a significantly negative effect on the price of pork and poultry. The reason is that the consumers may not have confidence in the pork and poultry certificates in

China. Our results about certification are consistent with the suggestions of Zhang *et al.* (2010), which indicates that certification seems to be having trouble in winning Chinese consumers' trust in determine food quality and safety. We also confirm their finding that there is a potential inefficiency of the existing certification programs in China and possible waste of political resources in regulating food quality and safety (Zhang *et al.*, 2010).

### **Household Income**

Obviously, consumers' evaluations of implicit price for quality meat are significantly related to household income. Both household income and the square of household income are included to test the implicit value of meat and the tendency of price premium's variation. Theoretically, consumers with high income levels will increase their demand for more luxurious foods. From our results, these families are willing to pay 4.074, 3.067, and 1.755 Yuan more as their incomes increase 1000 Yuan on one kilogram of the consumption of beef, lamb, and other meat, respectively. But the implicit price level for quality meat increases at a decreasing rate as the signs of quadratic terms of household head's income for beef and other meat are significantly negative. The possible reasons for these results are the affluent consumers are not relying on pork as their main meat source. These results indicate a diversified trend of meat consumption in urban China in recent years, which match the conclusion of some previous studies, for example, Gale and Huang (2007). The decreasing rate of the price premium on these types of meat reflects that consumers with high income levels may gradually reduce the amount of meat consumption in the long run and consume more healthy foods, such as vegetable, fruit and other foods. Another possible explanation for this result is that high income often is associated with

busy work and high income people are more likely to pay more on dining out or food away from home.

### **Household Wives' Educational Level and Children**

Traditionally, household wives play an important role on making purchasing decisions in Chinese family. Their awareness of nutrition and food safety can be related with the health of the whole family. The wife's educational level reflects their awareness of quality and safety, which will likely impact their valuation of meat accordingly, the household wives' education variable is added in the regression analysis. Meanwhile, China's national policy "one couple, one child" makes children the core of every family. So the child's health and nutrition are important concerns during the purchasing decision. In some countries such as the U. S., and U.K., parents are likely to pay a premium for the safety of baby food (Maguire *et al.*, 2004). The results of our analysis show that well-educated household wives in Beijing play a negative and significant role on evaluating lamb's purchasing price, and number of children has a positive and significant influence on the price of all kind of meat except for beef. These results indicate that Chinese consumers care more about children's health and they are willing to pay a price premium for meat if they have children.

### **Conclusion**

The meat market in China is quite a diversified and potentially huge market in the world, which always contains of great interest for policy makers and meat producers. Understanding the implicit price of meat which is related with quality in Beijing, China will provide a good guidance for people who are interested in the Chinese meat market. In this paper, we analyze the implicit price of meat with the quality-related attributes from

both supply and demand sides by applying a hedonic price model. Five meat categories plus several quality-related attributes are regressed in the model on households survey data collected from Beijing in 2007.

The key results in the current analysis indicate that some quality-related attributes or characteristics such as meat appearance, supermarket, meat brand, and processed meat as well as demographic variables like household head's income have a significantly positive influence on the price of meat, which suggest that consumers in Beijing are willing to pay a price premium to guarantee the quality and safety of meat. Besides those, the number of children also contains factors that will affect the implicit value of meat.

The current results find that the Chinese consumers' awareness of nutrition and safety has had a tremendous improvement. And the increasing demand for safer and branded meat may boost the development of the standardized meat production industry in China and the imports from other countries such as the U.S., Australia, and Argentina. Based on the potential inefficiency of the existing certification programs in China and possible waste of political resources in regulating food quality, the Chinese government still needs work in order to build a reliable and efficient meat certificate system in China.

**Table 3 Estimation Results Using Ordinary Least Squares**

Categories	Pork	Beef	Lamb	Poultry	Other
Intercept	2.780*** (0.115)	2.263*** (0.278)	3.322*** (0.508)	3.087*** (0.231)	2.605*** (0.208)
Meat Appearance	-0.059 (0.037)	0.149* (0.087)	0.382** (0.161)	-0.251** (0.074)	0.033 (0.061)
Semi-process	-0.061 (0.049)	0.294*** (0.069)	0.316 (0.195)	0.271*** (0.064)	0.102 (0.063)
Ready-to-eat	-0.076* (0.041)	0.115 (0.108)	-0.126 (0.167)	-0.017 (0.086)	0.129 (0.124)
Supermarket	0.171*** (0.054)	0.258** (0.104)	0.034 (0.177)	-0.177* (0.099)	-0.057 (0.105)
Wet Market	0.104 (0.070)	-0.055 (0.150)	-0.508** (0.213)	-0.448*** (0.137)	-0.649*** (0.161)
Meat certificate	-0.078** (0.037)	0.266** (0.082)	0.314** (0.150)	-0.250** (0.074)	-0.037 (0.058)
Meat brand	0.022 (0.037)	0.179** (0.089)	0.389** (0.154)	-0.085 (0.078)	0.103* (0.062)

Household Income	0.018 (0.018)	0.294*** (0.080)	0.321** (0.156)	-0.027 (0.044)	0.147*** (0.033)
(Household Income) <sup>2</sup>	-0.0001 (0.002)	-0.032*** (0.008)	-0.036* (0.022)	0.004 (0.004)	-0.011*** (0.003)
Wife's education	0.029 (0.018)	-0.012 (0.042)	-0.246** (0.084)	0.051 (0.036)	0.040 (0.033)
Child	0.0914** (0.032)	0.066 (0.074)	0.379** (0.143)	0.146** (0.061)	0.158** (0.059)
Adjusted R <sup>2</sup>	0.985				
<i>F- Stat</i>	1571.06				
<i>P-value</i>	< 0.000				
Number of observations	1429				

Note: 1. The standard errors are in parentheses.

2.\* significant at the 10% level; \*\* at 5% level; \*\*\* at 1% level.

**Table 4 Marginal Effect of the Intrinsic and Extrinsic Attributes on Meat Price**

Marginal Effect	Pork	Beef	Lamb	Poultry	Other
Meat Appearance	-0.898	1.544	13.023	-4.720	0.447
Semi-process	-0.927	3.328	10.403	6.619	1.835
Ready-to-eat	-1.147	1.171	-3.314	0.358	1.835
Supermarket	2.923	2.829	0.968	-3.449	-0.739
Wet Market	1.718	-0.514	-11.150	-7.678	-6.364
Meat Certificate	-1.176	2.929	10.327	-4.704	-0.484
Meat Brand	0.349	1.884	13.311	-1.733	1.446
Household Income	0.205	4.074	3.067	-0.189	1.755
Wife's education	0.305	-0.167	-2.539	0.535	0.487
Children	1.500	0.656	12.900	2.343	2.282

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